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Research Article [OPEN ACCESS]

Determinants of User Satisfaction with a Mobile Application Using the Extended Webqual 4.0 Method and Structural Equation Modelling: A Case of the PLN Mobile Application

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ABSTRACT

In the era of rapid technological growth, people increasingly expect convenience in all aspects of life, including how they interact with public services. The PLN Mobile application, developed by PT PLN (Persero), aims to facilitate access to information and services for the community. However, many users have provided low ratings and negative feedback. The purpose of this research is to analyze the factors influencing user satisfaction with the PLN Mobile application, using the Webqual 4.0 method. A total of 101 respondents were selected using a purposive sampling technique, and the data were analyzed using Structural Equation Modeling (SEM). The findings reveal that Usability, System Quality, Information Quality, and Interaction Quality significantly affect user satisfaction, while Service Quality does not. This indicates that the application meets most user expectations, though there is still potential for further improvement. These findings offer theoretical contributions to the Webqual 4.0 method and practical insights for developers to enhance the application and improve user satisfaction.

Keyword: PLN Mobile, user satisfaction, webqual 4.0

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1. INTRODUCTION

In the current era of rapid technological growth, there is an increasing demand for convenience in everyday tasks, driving the development of new technological innovations. These advancements not only accelerate work processes but also enhance efficiency and effectiveness across various sectors of life. In communication, for instance, instant messaging apps and social media platforms enable real-time global connectivity, facilitating faster and more accessible information exchange. Beyond addressing practical daily needs, these innovations also contribute to social and economic progress, fostering a more connected and sustainable world.

Due to the numerous benefits offered by information technology, many companies are integrating these innovations into their operations, including PT PLN (Persero), Indonesia's primary electricity provider. PT PLN (Persero) has implemented several updates to meet public demand for information, utilizing the latest communication technologies such as mobile services. One such innovation is the PLN Mobile application, designed to provide easy access to information and services through smartphones (Prasetyohadi & Suryani, 2022). The PLN Mobile app offers users a range of services, such as

paying electricity bills, checking billing information, reporting service disruptions, accessing blackout details, applying for new electricity connections, contacting customer service, and staying informed about promotions and company news (Tambunan & Hapsari, 2021; Wiguna et al., 2022; Yuliana et al., 2019).

Although the PLN Mobile application is designed to provide convenience, there are users who have given it a low rating of 1 star and left negative feedback on the Google Play store. Common complaints include difficulties in navigation, frequent bugs, errors during transactions, and challenges in reaching customer service. Despite these issues, interviews conducted with some active users revealed that they are generally satisfied with the application's performance. This sentiment is supported by previous research, such as a study conducted by Fauziah Gusni, which concluded that users are generally satisfied with the performance of PLN Mobile. Of the five dimensions of the EUCS model applied in the study, three were found to significantly influence user satisfaction, while two had no significant effect (Gusni et al., 2023). Another study by Arief Fujianto also supports this finding, noting that three out of four EUCS dimensions showed a significant effect, with only one dimension lacking a notable impact (Fujianto, 2019).

Given the significance of the PLN Mobile application to many users, further in-depth research on user satisfaction is necessary. To address this, the current study analyzes user satisfaction using a different method from previous research, with the goal of providing a more comprehensive explanation of the issues from an alternative dimensional perspective. Specifically, this research seeks to assess user satisfaction with the PLN Mobile application using the Webqual 4.0 method, involving direct user feedback through questionnaires. Data was collected from 101 respondents who are PLN Mobile users. The questionnaire was based on the variables of the Webqual 4.0 method, including Usability, System Quality, Information Quality, Service Quality, and Interaction Quality, and the data was analyzed using SmartPLS software.

The Webqual 4.0 method was selected due to its ability to effectively capture various aspects of user satisfaction with the application. By employing this more varied approach, the study aims to gain a deeper understanding of user needs and expectations, which can serve as a basis for future updates to the PLN Mobile application. Consequently, the development of the application can be carried out more effectively, maximizing its benefits to the public (Titiani et al., 2020).

2. LITERATURE REVIEW, HYPOTHESES, AND METHODS

2.1 Literature Review

Previous research serves as a benchmark for the current study, helping to guide the analysis. One of the key studies referenced is that of Gusni et al. (2023), which examines end-user satisfaction with the PLN Mobile application. The objective of Gusni's research was to evaluate user satisfaction levels using the End User Computing Satisfaction (EUCS) framework. This study employed a quantitative approach, utilizing a questionnaire to collect participant data. The findings indicate that EUCS dimensions such as ease of use, system quality, and technical support have a positive and significant impact on user satisfaction. In contrast, the dimensions of flexibility and security did not show a significant positive effect. Nonetheless, the research concludes that, overall, users are satisfied with the performance of the PLN Mobile application.

Additionally, research conducted by Fujianto (2019) analyzes end-user satisfaction with the PLN Mobile application. The study aimed to identify the factors that influence user satisfaction among customers of PT PLN (Persero) UP3 Jember, using the End User Computing Satisfaction (EUCS) framework. A quantitative approach was employed, with incidental sampling techniques applied to gather data from 100 respondents. The results revealed that content, accuracy, format, and timeliness had a positive and significant impact on user satisfaction, while ease of use, though positive, did not have a significant effect. The study emphasizes the importance of maintaining and improving the variables that have a positive and significant influence to prevent a decline in user satisfaction with the PLN Mobile application.

Furthermore, research conducted by Hamzah & Irawan (2023) also examines user satisfaction with the PLN Mobile application. The objective of their study was to assess user satisfaction at PT PLN (Persero) WS2JB Palembang Branch Sekayu using the Technology Acceptance Model (TAM) framework. The findings indicate that perceived ease of use has no effect on actual usage, whereas usage intentions significantly influence actual use.

2.2 PLN Mobile Application

The PLN Mobile application, developed by PT PLN (Persero), is designed to assist and facilitate the public in accessing fast and convenient services related to electricity issues. It was first introduced on October 16, 2016, during the 71st National Electricity Day celebration, with a formal launch by the PLN Board of Directors. The application was created in response to the growing demand for digital service technology and to cater to the needs of modern users (Saing & Suryanto, 2024). Through the PLN Mobile application, users benefit from a range of conveniences, such as the ability to easily pay for electricity tokens, submit and track complaints, and access important information related to electricity, among other features (Antikasari et al., 2023; Kusuma & Rahim, 2021; Salsabila et al., 2022).

2.3 Hypotheses and Methods

This research adopts a quantitative approach, with data being measured objectively and analyzed using statistical methods. The Webqual method is employed to evaluate the PLN Mobile application based on user feedback collected through a questionnaire. The study examines five independent variables: Usability (U), which assesses how easily and comfortably users interact with the application; System Quality (SQ), which evaluates the quality of the application's system; Information Quality (IQ), which measures the quality of the information provided by the application; Service Quality (SEQ), which assesses the quality of the service offered by the personnel managing the application; and Interaction Quality (INQ), which evaluates the quality of interactions facilitated by the application. User Satisfaction (US), the dependent variable, serves as the primary reference point for determining overall satisfaction and drawing conclusions based on the independent variables (Rahi & Abd.Ghani, 2019). The hypotheses of this research are presented in Figure 1, which illustrates the relationships between the independent variables and user satisfaction:

H1: Usability variables have a significant and positive influence on user satisfaction.
H2: System Quality variables have a significant and positive influence on user satisfaction.
H3: Information Quality variables have a significant and positive influence on user satisfaction.
H4: Service Quality variables have a significant and positive influence on user satisfaction.
H5: Interaction Quality variable has a significant and positive influence on user satisfaction.

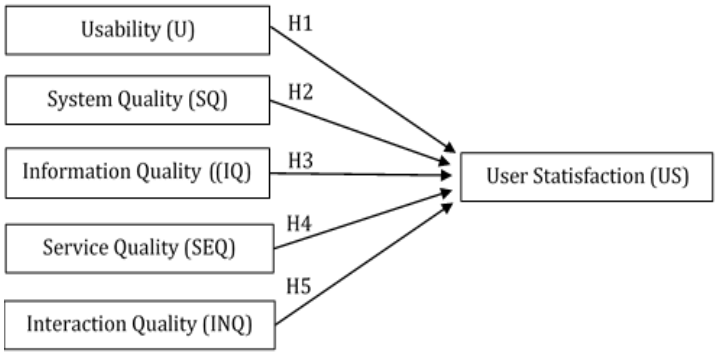

Figure 1. Conceptual Model of the Research Hypotheses

This section outlines the research flow, detailing the key stages undertaken throughout the study. These stages include problem identification, conducting a literature review, formulating hypotheses, data collection, data analysis, and concluding with the presentation of results and conclusions. The steps of the research process are illustrated in Figure 2. The research data was collected through a Google Form questionnaire distributed to 101 PLN Mobile users. The questionnaire included sections on respondent demographics, duration of PLN Mobile usage, instructions for completing the survey, and a series of statements designed to represent each variable for quantitative analysis. The research instruments used to measure these variables are detailed in Table 1.

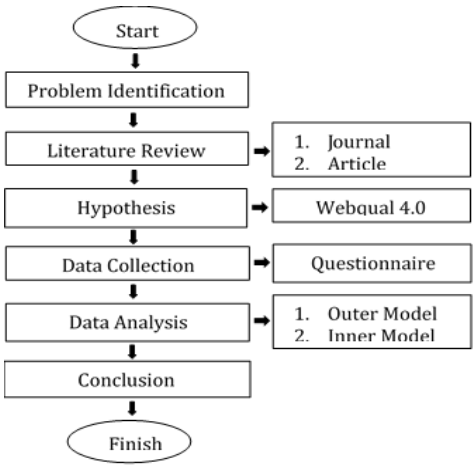

Figure 2. Research process

Table 1. Research instruments

Variable	Indicators	Code
Usability	PLN Mobile is Easy to Use	U1
	PLN Mobile navigation is not difficult to understand	U2
	PLN Mobile is Always Responsive When Used	U3
	PLN Mobile Features are Easy to Run	U4
	Attractive PLN Mobile Display Design	U5
System Quality	PLN Mobile Rarely Experiences Errors / Disruptions	SQ1
	PLN Mobile Responds Quickly When Used	SQ2
	Features in the PLN Mobile Rarely Experience Bugs / Governments That Do Not Match Expectations	SQ3
	PLN Mobile always provides regular updates	SQ4
	PLN Mobile is Always Reliable in Emergency Situations	SQ5
Information Quality	PLN Mobile provides all the information users want	IQ1
	Information Provided by PLN Mobile is Always the Latest	IQ2
	Information Given by PLN Mobile is Complete	IQ3
	Information Given by PLN Mobile is Easy to Understand	IQ4
	Information Given by PLN Mobile is Useful and Helpful	IQ5
Service Quality	PLN Mobile Customer Service provides a Fast Response When Contacted	SEQ1
	PLN Service Officers in the PLN Mobile are Always Available to Help Whenever Needed	SEQ2
	PLN Service Officers in the PLN Mobile are Always Responsible for Helping Fix Electricity Problems	SEQ3
	PLN Service Officers in the PLN Mobile Always Provide the Best Service	SEQ4
	PLN Service Officers in the PLN Mobile are Always Able to Solve All Electricity Problems	SEQ5
Interaction Quality	PLN Mobile Always Facilitates Two-Way Interaction	INQ1
	Easy Interaction in PLN Mobile	INQ2
	PLN Mobile Always Provides Fast Responses When Interacting	INQ3
	PLN Mobile Design is Well Designed Making Interaction Easy to Understand	INQ4
	PLN Mobile Provides Clear Guidelines and Easy-to-Follow Steps	INQ5
User Satisfaction	I feel Satisfied Overall Display of PLN Mobile	US1
	I feel satisfied with PLN Mobile because it always fulfills the information I need.	US2
	I feel satisfied with PLN Mobile's performance	US3
	I feel satisfied with the effectiveness of PLN Mobile	US4
	Overall, I feel Satisfied with PLN Mobile	US5

2.4 Data Analysis

The analysis technique employed in this research is the Partial Least Squares-based Structural Equation Modeling (PLS-SEM). The PLS-SEM model is used to analyze latent variables, indicator variables, and measurement errors. It requires primary data, which can be collected through questionnaires (Lubis et al., 2019; Naz'aina et al., 2023). Data processing and analysis for this study were conducted using the SmartPLS software, which includes the following components (Hair et al., 2019; Niehaves & Ortbach, 2016):

1. Measurement Model Analysis (Outer Model)
   The measurement model analysis is a statistical approach used to test the validity and reliability of constructs or latent variables. Its purpose is to ensure that the instrument or measurement tool accurately assesses the intended constructs and confirms the validity of the latent structure.
2. Structural Model Analysis (Inner Model)
   The structural model analysis is a statistical method used to examine the relationships between latent variables and the underlying theoretical model. It highlights the relationships and influences between latent variables within the research model.

3. RESULTS AND DISCUSSION

3.1 Respondent Demographics

The data collection results were obtained from 101 respondents, all of whom are students from the Informatics Engineering Study Program at the University of Papua and users of the PLN Mobile application. This data covers various aspects of their usage and experience with the application. The respondent data is presented in Table 2.

Table 2. Profile of respondents

No.	Category	Item	Total	Presentation
1	Age	12-17	0	0%
		18-25	98	98%
		26-31	2	2%
		>32	0	0%
2	How long have you been using the PLN Mobile application?	< 1 Year	42	42,5%
		> 1 Year	57	57,6%

The respondents were categorized into four age groups. The group that used the PLN Mobile application the most was the 18-25 age group, with 99 respondents, representing 98% of the total. This high percentage is largely due to the majority of respondents being active students from the 2020 cohort. The 26-31 age group followed with 2 respondents, accounting for 2% of the total, primarily consisting of lecturers who participated in the survey. The 12-17 and >32 age groups had no respondents, representing 0% of the sample.

Respondents were also categorized based on how long they had been using the PLN Mobile application. The "<1 Year" group included 42 respondents, representing 42.5%, while the ">1 Year" group consisted of 57 respondents, making up 57.6% of the total.

3.2 Measurement Model Analysis (Outer Model)

Measurement model analysis involves conducting validity and reliability tests to ensure that the instruments used in the research are valid, and that the data collected is accurate and relevant. This step is essential for ensuring that the conclusions drawn from the research are reliable. Structural model analysis is a crucial preliminary step that must be completed before proceeding with the structural model analysis itself (Inan et al., 2023). In this study, several tests are conducted to analyze the measurement model, including the convergent validity test, discriminant validity test, Heterotrait-Monotrait Ratio (HTMT) test, and the reliability test.

The convergent validity test is used to assess the degree to which the indicators of a variable align with the theoretical constructs. Convergent validity is tested through two stages: first, by checking the loading factor for each construct indicator, which is considered valid if the value exceeds 0.70. Second, the Average Variance Extracted (AVE) is examined, and it is deemed valid if the value exceeds 0.50. The AVE is a critical indicator for ensuring that the construct of the measurement model has sufficient validity, which helps to increase confidence in the analysis results. The following section presents the results for the loading factors and AVE in this research. The results for the loading factors and AVE are shown in Figure 3 and Table 3.

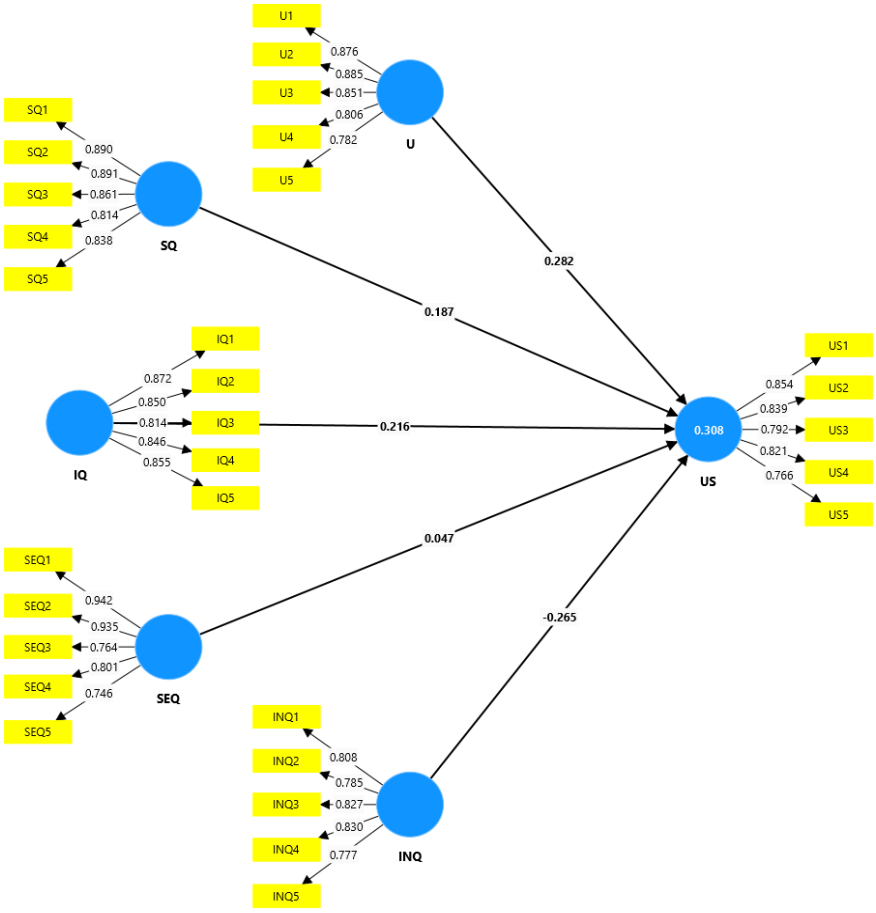

Figure 3. Outer model loading factor

Table 3. Average Variance Extracted (AVE) results

Variable	AVE Value
Interaction Quality (INQ)	0,649
Information Quality (IQ)	0,719
Service Quality (SEQ)	0,709
System Quality (SQ)	0,739
Usability (U)	0,707
User Satisfaction (US)	0,664

The discriminant validity test can be assessed through the cross-loading test results. The cross-loading test is essential for evaluating the discriminant validity of latent constructs, ensuring that indicators designed to measure distinct constructs do not exhibit high correlations with one another. Discriminant validity is confirmed when the cross-loading values of an indicator are higher for their associated construct compared to other constructs. To meet the standard for discriminant validity, the cross-loading value for each variable should exceed 0.7. The cross-loading values for this study are shown in Table 4.

Table 4. Cross-loading results

	INQ	IQ	SEQ	SQ	U	US
INQ1	0.808	0.118	0.400	0.245	0.182	-0.106
INQ2	0.785	0.126	0.302	0.080	0.203	-0.086
INQ3	0.827	0.185	0.433	0.023	0.163	-0.089
INQ4	0.830	0.195	0.206	-0.079	0.134	-0.137
INQ5	0.777	0.163	0.308	0.120	0.254	-0.060
IQ1	0.209	0.872	0.322	0.405	0.487	0.390
IQ2	0.118	0.850	0.349	0.301	0.271	0.266
IQ3	0.171	0.814	0.368	0.324	0.301	0.334
IQ4	0.216	0.846	0.328	0.349	0.348	0.277
IQ5	0.101	0.855	0.329	0.283	0.248	0.267
SEQ1	0.382	0.394	0.942	0.205	0.172	0.109
SEQ2	0.372	0.376	0.935	0.139	0.094	0.109
SEQ3	0.346	0.235	0.764	0.044	0.028	0.024
SEQ4	0.324	0.315	0.801	0.165	0.108	0.051
SEQ5	0.154	0.285	0.746	0.148	0.044	0.016
SQ1	-0.017	0.336	0.180	0.890	0.367	0.331
SQ2	0.086	0.407	0.159	0.891	0.470	0.344
SQ3	0.033	0.309	0.036	0.861	0.413	0.393
SQ4	0.093	0.280	0.119	0.814	0.334	0.265
SQ5	0.158	0.373	0.282	0.838	0.492	0.353
U1	0.162	0.326	0.051	0.448	0.876	0.318
U2	0.170	0.391	0.158	0.436	0.885	0.439
U3	0.160	0.275	0.143	0.365	0.851	0.337
U4	0.224	0.414	0.112	0.409	0.806	0.328
U5	0.227	0.268	0.052	0.393	0.782	0.248
US1	-0.122	0.314	0.103	0.213	0.227	0.854
US2	-0.117	0.229	0.142	0.341	0.283	0.839
US3	-0.123	0.383	-0.021	0.285	0.282	0.792
US4	-0.168	0.349	0.120	0.399	0.412	0.821
US5	0.044	0.209	0.052	0.347	0.426	0.766

After conducting the cross-loading test, the next step in testing discriminant validity is the Heterotrait-Monotrait Ratio (HTMT) test. Discriminant validity is considered satisfactory if the HTMT value is less than 0.90, indicating that the constructs are distinct from one another (Aisyah et al., 2023; Risdiyanto et al., 2024) The HTMT values for this research are presented in Table 5. In addition to validity testing, it is essential to conduct a reliability test when analyzing the measurement model. The reliability test ensures that the measurement instrument consistently produces reliable results when used repeatedly. To assess reliability, Cronbach's alpha and composite reliability values are examined. A value greater than 0.70 indicates that the instrument is reliable (Oktavia et al., 2024). The results of the reliability test are shown in Table 6.

Table 5. HTMT test

	INQ	IQ	SEQ	SQ	U	US
INQ						
IQ	0.213					
SEQ	0.430	0.416				
SQ	0.164	0.430	0.196			
U	0.268	0.427	0.126	0.534		
US	0.161	0.399	0.115	0.429	0.438	

Table 6. Reliability test

	Cronbach's Alpha	Composite Reliability
INQ	0.867	0.902
IQ	0.903	0.927
SEQ	0.909	0.923
SQ	0.912	0.934
U	0.897	0.923
US	0.874	0.908

3.3 Structural Model Analysis (Inner Model)

Structural model analysis is crucial for understanding how variables are interconnected and influence one another within a model. In this research, the evaluation of the size and significance of these relationships will be conducted to test the proposed hypotheses. Several tests were employed in the structural model analysis, including the Variance Inflation Factor (VIF) test and the Determinant Coefficient (R-Square) test, to assess the validity of the hypotheses.

The VIF test is used to assess collinearity among the constructs in the research model. This test ensures that the constructs do not exhibit excessive interrelationships, which could affect the model's validity. A VIF value is considered acceptable if it falls between 0.2 and 5, indicating that the construct does not suffer from collinearity issues. As shown in Table 7, all variables meet the required standard values, indicating that the independent variables exhibit good collinearity with the dependent variable.

Table 7. Variance Inflation Structure (VIF) test

	INQ	IQ	SEQ	SQ	U	US
INQ						1.239
IQ						1.471
SEQ						1.381
SQ						1.414
U						1.470
US						

The R-square value is used to assess the impact of independent latent variables on the dependent variable. The R-square value ranges from 0 to 1, with values closer to 1 indicating a stronger model fit. An R-square value of 0.75 is considered strong, 0.50 is moderate, and 0.25 is weak. As shown in Table 8, the dependent variable in this research has an R-square value of 0.308, meaning that the independent variables explain 30.8% of User Satisfaction (US), while the remaining 69.2% is influenced by variables outside the scope of this study. Therefore, the R-square value in this research is interpreted as moderate.

The purpose of hypothesis testing is to determine whether the obtained data values are strong enough to reject the null hypothesis and accept the alternative hypothesis. This is done by comparing the t-statistics and P-values using the bootstrap method. A hypothesis is accepted if the t-statistic value exceeds 1.96 at a 5% significance level, and the P-value is less than 0.05. The results of hypothesis testing are presented in Table 9.

Table 8. R-Square test

	R-square	R-square adjusted	Description
US	0.308	0.271	Moderate

Table 9. Path coefficient test

Hipotesis	Path Coefficient	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	Desc.
H1	U -> US	0.282	0.285	0.113	2.493	0.006	Accepted
H2	SQ -> US	0.187	0.181	0.095	1.968	0.025	Accepted
H3	IQ -> US	0.216	0.214	0.123	1.750	0.040	Accepted
H4	SEQ -> US	0.047	0.050	0.119	0.400	0.345	Rejected
H5	INQ -> US	-0.265	-0.264	0.131	2.029	0.021	Accepted

4. CONCLUSION

The conclusion drawn from this research is that, despite negative reviews on the Google Play Store regarding difficulties in using the PLN Mobile application—such as confusing navigation, frequent bugs,

transaction errors, and difficulties in contacting customer service—the research findings present a contrasting view. The study shows that, overall, users are satisfied with the display, system, information, and interaction aspects of the application.

This conclusion is supported by the relatively high ratings given by users who downloaded the PLN Mobile application on the Android platform. These ratings suggest that the application has largely met user experience expectations. However, there is still room for improvement. This research informs the developers that usability, interaction quality, system quality, and information quality are key factors influencing user satisfaction. The only aspect that remains below user expectations is the service quality, indicating that improvements in this area may not significantly impact user satisfaction.

This study was conducted using the Webqual 4.0 method, supported by SmartPLS software, and analyzed through the PLS-SEM model. All tests performed on the measurement model yielded valid results for all measurement items. Additionally, the structural model analysis, particularly the VIF test, showed that all independent variables demonstrated good collinearity with the dependent variable. The R-Square test indicated that the independent variables account for 30.8% of the variance in user satisfaction.

Hypothesis testing further revealed that Usability (U), System Quality (SQ), Information Quality (IQ), and Interaction Quality (INQ) have a significant impact on user satisfaction, while Service Quality (SEQ) does not. Based on these findings, it can be concluded that the PLN Mobile application generally meets user expectations and is considered satisfactory by its users.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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